

Human Factors and proposed JAR 145 maintenance requirements

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1. JAA Policy on Maintenance Human Factors

In the recent years, a lot of research on Maintenance Human Factors have been made; a number of conferences and symposia have been organised, and we can already see a growing interest for this matter in the aircraft maintenance industry.

Making research, organising conferences, symposia on human factors are certainly necessary to improve the knowledge on the issue, but this might not be enough. To make the aviation maintenance industry safer, we need to ensure that all concerned maintenance organisations will implement human factors concepts, appropriate to the size and scope of their organisation. In other words, our concern is that a Maintenance Human Factors culture should flourish in the whole maintenance industry.

Apparently a number of maintenance organisations in Europe have shown interest in Maintenance Human Factors and have started to implement comprehensive and voluntary Human Factors programmes. But still the majority of maintenance organisations have not achieved anything despite a large amount of publications, guidance material, etc. that are already available to them.

I believe that everyone would agree that the implementation of Human Factors concepts in the Maintenance Industry or in any Industry would need a cultural change. However cultural changes do not impose themselves. Even if there is evidence that such a cultural change is needed.

The JAA believe that the role of the National Aviation Authority is to initiate and accompany this cultural change.

Therefore the JAA policy is that an adequate Maintenance Human Factors culture can only flourish if it is supported by an appropriate regulatory change.

2. JAA Rulemaking Process

Before explaining where the JAA are in the development of Maintenance Human factors regulation, it might be useful to briefly review the JAA rulemaking process. In summary, we could say that in general:

- (a) A new regulatory subject may be proposed by anyone.
- (b) The new regulatory subject has to be accepted by the JAA Committee (upper decision level).
- (c) A draft proposal is normally made by a dedicated working group set up by the JAA; the working group generally includes experts from both Authorities and the

Industry.

(d) The draft regulation proposal must be accepted by the relevant JAA Division and Sectorial Team (lower decision level), plus the JAA Regulation Sectorial Team, who ensure the conformity with the JAA regulation standard.

(e) The final proposal must be submitted to the public for comment through the so-called NPA (Notice of Proposed Amendment) process.

(f) Based upon the NPA comments, the final rule is prepared by the dedicated working group. Then it is proposed to the relevant JAA Division and Sectorial Team (lower decision level) for acceptance.

(g) The final step before publication is the approval by the JAA Committee (upper decision level).

The duration of the whole process is variable. It could be 18 months for a simple amendment and 5 years or more for an initial rule, requiring possibly more than 1 NPA.

3. JAA Publications

The JAA publish 2 types of document: the Joint Aviation Requirements (JARs) and the Administrative and Guidance Material

JARs themselves include the JAR properly speaking and AMCs (Acceptable Means of Compliance) and IEMs (Interpretative and Explanatory Material). For Maintenance regulations, an AMC, so long as it is the only AMC published for a JAR paragraph, is the acceptable means of compliance. JAA AMC are in this respect very different to FAA AC (Advisory Circulars) in that ACs are optional, not AMCs

The Administrative and Guidance Material contains two main types of publications:

(a) The procedures, which spell out an administrative process to be followed by the JAA National Aviation Authority (JAA-NAA). Typical maintenance procedures are: application for a JAR 145 approval, JAR 66 examination procedure, etc...

(b) The Temporary Guidance Leaflets (TGLs), which are not subject to the NPA process and include guidance material intended to better explain the intent of a JAR or provide an improved or additional means of compliance with a JAR. TGLs are normally incorporated into the rule through the NPA process as a new AMC or IEM after a two-year probation period. JAA-NAA are not obliged to apply a TGL, but if applied, it becomes applicable to the whole Industry of that country. As for Maintenance TGLs the practice is that if the JAA-NAA does not apply one of them, then all JAA National Aviation Authorities should be informed via the JAA Maintenance Division

4. The JAA Maintenance Human Factors Working Group

The JAA Committee decided, in December 1998, to set up a JAA Maintenance Human Factors Working Group with the view of improving the JAR 145 requirements in the light of recent developments in Maintenance Human Factors research.

The Group had its first meeting in January 1999 and includes a balanced membership of "Authority" representatives (5) and "Industry" representatives (5)

The agreed working method was the following:

At a first stage, the working group would review and analyse information, data, incident/accidents reports, publications, research material, etc..., in order to identify Maintenance Human Factors Issues and classify them by order of importance. It was decided to give a level of criticality (from 1 to 3) to each human factor topic.

The working Group would then work on the more critical issues, being understood that less critical issues could be incorporated in the rule at a later stage. The prevailing idea was to avoid overweighing the NPA on Human Factors with too many issues, the risk being that the NPA process could be delayed by too many comments on secondary issues.

The working group was then required to establish a detailed work plan, to show which issue would be addressed and how it would be addressed (by a JAR change, and AMC/IEM or a TGL)

The working group identified two categories of issues: those that can be addressed through an organisation rule change ("organisational issues") and those that can be addressed through a dedicated Human Factors training ("training issues"). Obviously some issues belong to both groups

For instance the performance of "Duplicate Inspections" is typically an organisational issue, while the "Limitation of Human Performance" is a training issue, but the development of a good "Safety Culture" pertains to both groups.

At a second stage the working group had to draft an NPA based upon the detailed work programme. The drafting phase has been completed on January 2001, then submitted to the Maintenance Sectorial Team, who in turn will discuss it during their March meeting.

5. Draft NPA on Maintenance Human Factors

The proposed change to JAR 145 on Maintenance Human Factors will be published as NPA 145-12.

The draft NPA is only a proposal made by the Maintenance Human Factors Working Group and cannot be construed as an official JAA proposal.

The proposals made in this Draft NPA 145-12 are based on industry best practice and sound scientific research. They attempt to apply some of the good human factors principles already established in flight operations and air traffic control, to the maintenance industry.

Furthermore, this NPA is intended to comply with the recent ICAO Annex 6 changes on Maintenance Human Factors:

As mentioned above, draft NPA 145-12 includes two types of changes:

- (a) Changes affecting the JAR 145 approved maintenance organisation itself – qualified as "organisational issues"–, such as a new paragraph on "maintenance planning" and an improved paragraph on "maintenance data".
- (b) Changes affecting maintenance personnel, more specifically the introduction of a Human Factors training requirement –qualified as "training issues".

This draft NPA proposes to address the following Human Factors Issues:

Organisational issues:

(a) Design / Maintenance Interface

Inaccuracies, ambiguities, etc in maintenance data may lead to maintenance errors. Indirectly, they may also encourage or give good reasons to maintenance personnel to deviate from these instructions.

The proposed new JAR and AMC would require that inaccurate, ambiguous, incomplete maintenance procedures practices, information or maintenance instructions contained in the maintenance data used by personnel be notified to the TC holder.

(b) Safety culture

While it is recognised that it is impractical to write a requirement demanding a safety culture, one can write requirements and guidance material that set out the elements that would enable one to flourish.

New proposed JAR paragraph would require the maintenance organisation respectively to establish and publish the organisation's safety policy. AMC material would identify the accountable manager as the person responsible for establishing and promoting this safety policy.

Another key element for the development of a safety culture is a "Maintenance Error Management System" which consists of a closed loop occurrence & safety hazard reporting, recording & investigation system. A similar system has already been proposed through NPA 145-10 and the JAA Maintenance Human Factors working group considers that NPA 145-10 proposes an acceptable basis for an Maintenance Error Management System.

(c) Procedural Non-compliance

Failure to comply with good maintenance procedures can hardly be covered by regulation. It is a matter of education, safety culture and discipline. However, failure to comply with poor procedures, can be minimised by focusing the requirement on a system that ensures procedures are accurate, appropriate and reflect best practice

A proposed revision to JAR 145 would require that human factors principles be taken into account when establishing and writing procedures, and new AMC material would recommend, among other things, the involvement of the end users in writing the procedures, the verification and validation of the procedures, and an effective mechanism for reporting errors and ambiguities and changing / updating the procedures.

(d) Shift and task handover

This is a routine process that repeatedly appears in accident and incident reports.

A proposed new JAR 145 paragraph would specifically requires a shift and task handover procedure acceptable to the NAA and AMC material would provide material that describes best practice based on current knowledge and scientific research.

(e) Fatigue

The effect of fatigue on maintenance errors is a well established fact.

A proposed new JAR 145 paragraph would require the organisation's planning procedures to take into account the limitations of human performance, focusing on the fatigue aspect.

The JAA will not be addressing fatigue through duty time limitations, as this will be

covered in the longer term by the EU working time directive.

(f) Duplicate Inspections

Error capturing forms an important element of the safety net in the approved maintenance organisation. Duplicate inspections may be a means of capturing maintenance errors, but not necessarily the only means. New AMC material would recommend that duplicate inspections be considered as a possible means of error capturing, providing additional guidance as to the circumstances where this may be warranted.

(g) Poor planning of tasks, equipment and spares

Current JAR 145 does not require a procedure on planning of work. However, the absence of effective planning may contribute towards increased work pressure, which itself may lead to deviation from procedures. Deviation from procedures is known as a contributing factor in many aircraft incidents and accidents.

Proposed new JAR and AMC material would clarify the objective of good planning and include further guidance on elements to consider when establishing the planning procedure.

(h) Signing off tasks not seen or checked

Recent research proved that many maintenance tasks are signed off while not seen or checked by authorised personnel, potentially leading to incomplete maintenance.

New AMC material would elaborate on the meaning of sign-off and the need to self-check or inspect the task before signing off.

Training issues

The development of a human factors related skills and knowledge in the maintenance organisation can only be achieved through the training of all concerned maintenance personnel on the subject.

The Working Group proposed to add a new JAR paragraph on Human factors initial and continuation training for all maintenance staff and the related AMC material explains the objectives, personnel involved etc. The training syllabus would be included in an Appendix to JAR 145

Contrarily to JAR 66 Appendix 1, this syllabus does not include knowledge level requirements. The intent is at a first stage to give the maintenance organisation the flexibility to adapt the training syllabus to the size and workscope of the organisation.

6. Additional documentation

In addition to the draft NPA, the JAA Maintenance Human Factors Working Group has prepared draft Temporary Guidance Leaflets (TGLs) on various subjects such like detailed guidance on Maintenance Human Factors Training and Occurrence Management Schemes. The Working Group proposal is to issue these TGLs during the implementation phase of the NPA, where the need for additional guidance arises.

7. Implementation issues

This implementation of a Human Factors Training procedure in the JAR 145 approved maintenance organisations, as proposed by the working group, would require time and

resources. In particular, the development of dedicated Maintenance Human Factors training courses and the phasing in of personnel into these training courses will take time. Accordingly the Working Group proposed a two-year implementation phase for Human Factors training.

The second implementation issue is the applicability of the NPA. Shall it apply to the whole maintenance industry, or shall we limit its scope to e.g. heavy aircraft maintenance organisations? This issue has been left open by the working group and will be discussed by the JAA Maintenance Sectorial Team in March 2001.

8. Next steps

As shown above, the release of the draft NPA by the Working group is the first important step in the rulemaking process. Next important steps will be review of the draft NPA by the Maintenance Sectorial Team, the NPA comment process, and the final approval by the JAA Committee.

As far as I am concerned, I consider the NPA step of paramount importance. It is vital for the successful implementation of the JAR 145 amendment on Human Factors, that the Aviation Maintenance Industry reviews the NPA carefully and provides the JAA with detailed comment.

I hope that this presentation will contribute to make useful publicity on future NPA 145-12

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